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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/851,313	05/09/2001	Tatsuya Usami	NEC01P069-MSb	2820

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EXAMINER

MALDONADO, JULIO J

ART UNIT PAPER NUMBER

2823

DATE MAILED: 07/11/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/851,313

Applicant(s)

USAMI, TATSUYA

Examiner

Julio J. Maldonado

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 April 2005.
2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,4-6,8 and 31-52 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1, 2, 4-6, 8, 31-52 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 20030423 20050128 20050513
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☒ Other: IDS dated/filed: 20050423

DETAILED ACTION

1. The rejection as set forth in Office Action mailed on 01/26/2005 is withdrawn in view of applicants' amendments filed on 04/26/2005.
2. The cancellation of claims 3, 7 and 9-30, and the addition of claims 47-52 are acknowledged.
3. Claims 1, 2, 4-6, 8, 31-52 are pending in the application.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1, 4, 5, 8, 31, 34, 35, 37, 38, 41-45, 47-49 and 52 are rejected under 35 U.S.C. 102(e) as being anticipated by Yau et al. (U.S. 6,054,379).

In reference to claims 1, 5, 31, 35, 41, 42, 48, 49 and 52, Yau et al. (Fig.10H) teach a semiconductor device having an interconnect structure including a first insulation layer (710) comprising an organic material having a dielectric constant which is lower than a silicon oxide dielectric constant; a second insulation layer (714, 716, 718) consisting of three layer and including a polysiloxane compound having an Si-H group and formed on and adhering to a top of said first insulation layer (710); a third insulation layer (722) comprising an

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inorganic material and formed on and adhering to a top of said second insulation layer (714), the first (710), second (714, 716, 718) and third (722) forming a multi-layered insulation film; and a plurality of wires (724) which are formed in grooves formed in said multi-layered insulation film filling a space between said wires (724), wherein said second insulation layer (714, 716, 718) comprises a hydride organosiloxane, and said second insulation layer (714, 716, 718) comprises a layer to improve an adhesion property between said first insulation layer (710) and said third insulation layer (722) (column 13, lines 12 – 663).

In reference to claims 4 and 8, Yau et al. teach wherein said third insulation layer comprises at least one material selected from the group including silicon oxide (column 13, lines 19 – 22).

In reference to claims 34 and 47, Yau et al. teach wherein said first insulation layer comprises a thickness greater than a thickness of said second insulation layer; and wherein said first insulation layer can have a thickness greater than a thickness of said third insulation layer (column 13, lines 12 – 22).

In reference to claim 37, Yau et al. teach wherein a bottom of said groove is formed on a same surface as said first insulation layer (Fig.10H).

In reference to claim 38, Yau et al. teach wherein said plurality of wires comprises copper wires (column 13, lines 47 – 63).

In reference to claim 43, Yau et al. teach wherein said first insulation layer, said second insulation layer and said third insulation layer of said multi-layered insulation film comprise substantially uniform widths (Fig.10H).

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In reference to claim 44, Yau et al. teach wherein a surface of said multi-layered film is substantially coplanar with a surface of said plurality of wires (Fig.10H).

In reference to claim 45, Yau et al. teach wherein said second insulation layer is formed by plasma CVD (column 4, line 19 – column 5, line 19).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 2, 6, 32, 36, 50 and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yau et al. (U.S. 6,054,379) as applied to claims 1, 4, 5, 8, 31, 34, 35, 37, 38, 41-45, 47-49 and 52 above, and further in view of The Applicants Admitted Prior Art.

Yau et al. substantially teaches all aspects of the invention including a first dielectric layer such as parylene, FSG, silicon oxide, or the like (Yau et al., column 13, lines 12 – 16) and wherein metal lines can be included on the substrate wherein said first dielectric layer covers a space between said metal lines (Yau et al., column 10, line 18 – column 11, line 43), but fails to disclose wherein dielectric layer is an organopolysiloxane including methyl silsesquioxane (MSQ) and wherein said wires connect a plurality of gate electrodes formed on said substrate with an upper level in the device, said first insulation layer formed

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on and between said gate electrodes, wherein said plurality of wires comprises a contact which contacts a diffusion region formed in said substrate between said plurality of gate regions, wherein a spaced formed between adjacent gate electrodes in said plurality of gate electrodes is filled with said first insulation layer and wherein a spaced formed between adjacent gate electrodes in said plurality of gate electrodes filled with said first insulation layer. However, the prior art (Instant Figs.8a-9b) teaches a device having a plurality of gate electrodes (60) having diffusion regions (54) formed on a substrate (51); and a first insulation layer (55) over said substrate (51) having a wiring connection between the gate electrodes through a diffusion region (54) locates between said gate electrodes (60), wherein said first insulation layer includes methyl silsesquioxane, and wherein said wiring connects said gate electrodes to an upper level (Instant page 2, lines 5 – 8 and page 5, lines 9 – 24). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Yau et al. with the teachings of the prior art to substitute the dielectric material taught by Yau et al. for the SOG material disclosed by the prior art because using MSQ reduces crosstalk between metal wires (Instant page 2, lines 12 – 15) and because the selection of a known material based on its suitability for its intended use supported a prima facie obviousness. MPEP 2144.07. It would also have been obvious to one of ordinary skill in the art to combine the teachings of Yau et al. and the prior art to substitute the metal lines of Yau et al. with the electrodes disclosed in the prior art to arrive at the claimed invention.

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8. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yau et al. (U.S. 6,054,379) in view of the prior art as applied to claims 1, 2, 4-6 8, 31, 32, 34-37, 38, 41-45 and 47- 52 above, and further in view of Aoi (U.S. 6,333,257 B1).

Yau et al. substantially teaches all aspects of the invention including a first dielectric layer such as parylene, FSG, silicon oxide, or the like (Yau et al., column 13, lines 12 – 16) but fail to teach using first insulation layer comprising polyaryl ether. However, Aoi (Figs.4a-11c) teaches a multilayered insulation film having wiring embedded therein, wherein interlayer insulation layer (204) comprises any arbitrary material such as fluorinated polyimide and polyaryl ether (column 10, lines 1 – 11). It would have been within the scope of one of ordinary skill in the art to combine the teachings of Yau et al. with the teachings of Aoi to enable using the dielectric materials of Aoi in Yau et al. because one of ordinary skill in the art at the time the invention was made would have been led to the conclusion that the selection of known materials based on its suitability for its intended use supported a prima facie obviousness. MPEP 2144.07.

9. Claims 39, 40 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yau et al. (U.S. 6,054,379) as applied to claims 1 and above, and further in view of Allada et al. (6,218,317 B1) alone or in combination with Chen et al. (Effects of slurry formulations on chemical-mechanical polishing of low dielectric constant polysiloxanes: hydrido-organo siloxane and methyl silsesquioxane).

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Yau et al. substantially teach all aspects of the invention but fail to disclose wherein said second insulation layer comprises methylated hydrogen silsesquioxane film (MHSQ) at a thickness of about 50 nm, wherein said dielectric layer includes repeating units of $(\text{SiCH}_3\text{O}_2)_n$, $(\text{SiO}_2\text{H})_n$ and $(\text{SiO}_3)_n$, wherein a molar ratio of $(\text{SiO}_2\text{H})_n$ to a total of said repeating units is at least 0.2. However, Allada et al. (Figs. 1a-1b) in a related art to the formation of copper interconnect structures teach a second insulating film comprising a methylated hydrido organo siloxane polymer (HOSP), wherein said polymer can be formed by spin coating processes or by conventional CVD processes (column 2, lines 7 – 67).

Furthermore, according to Chen (Fig. 1), methylated hydrido organo siloxane polymer (HOSP) includes repeating units of $(\text{SiCH}_3\text{O}_2)_n$, $(\text{SiO}_2\text{H})_n$ and $(\text{SiO}_3)_n$, wherein a molar ratio of $(\text{SiO}_2\text{H})_n$ to a total of said repeating units is at least 0.2.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use the insulating layer as taught by Allada et al. in the interconnect formation structure of Yau et al., since this dielectric layers exhibit low dielectric constants and also have better adhesion properties than conventional dielectric layers (Allada et al., column 1, lines 37 – 60 and column 2, lines 36-48).

The combined teachings of Yau et al. and Allada et al. fail to teach wherein said MHSQ film comprises a thickness of about 50 nm. Notwithstanding, it would have been an obvious matter of design choice bounded

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by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose these particular dimensions because applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966).

Response to Arguments

10. Applicant's arguments with respect to claims 1, 2, 4-6, 8, 31-52 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory

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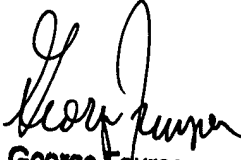
action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Julio J. Maldonado whose telephone number is (571) 272-1864. The examiner can normally be reached on Monday through Friday.

13. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (571) 272-1855. The fax number for this group is 703-872-9306 for before final submissions, 703-872-9306 for after final submissions and the customer service number for group 2800 is (703) 306-3329. Updates can be found at <http://www.uspto.gov/web/info/2800.htm>.

Julio J. Maldonado
July 7, 2005

Julio J. Maldonado
Patent Examiner
Art Unit 2823


George Fourson
Primary Examiner